(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 341 717 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.07.1997 Bulletin 1997/30

(51) Int Cl.[6]: **G06K 7/10**

(21) Application number: **89108500.3**

(22) Date of filing: **11.05.1989**

(54) **Mirrorless scanner with movable laser and optical components**

Spiegelfreier Abtaster mit beweglicher Laserquelle und beweglichen, optischen Komponenten

Dispositifs de balayage sans miroir, à composants laser et optique récepteur mobiles

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **11.05.1988 US 193265**

(43) Date of publication of application:
15.11.1989 Bulletin 1989/46

(60) Divisional application:
93120433.395117822.796201913.996202253.9

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D scription

This invention generally relates to light scanner systems for reading indicia of different light reflectivity such as bar code symbols and, more particularly, to so-called "mirrorless scanner systems" wherein system components, other than mirrors, are employed to effect at least some sweeping or scanning of symbols to be read.

Light scanner systems and components of the type exemplified by US-A-4,251,798; US-A-4,360,798; US-A-4,369,361; US-A-4,387,297; US-A-4,593,186; US-A-4,496,831; US-A-4,409,470; US-A-4,460,120; US-A-4,607,156 and US-A-4,673,803 have generally been designed to read indicia having parts of different light reflectivity, e.g. bar code symbols, particularly of the Universal Product Code (UPC) type, at a certain working or reading distance from a hand-held or stationary scanner.

Typically, a light source such as a laser generates a light beam which is optically modified to form a beam spot of a certain size at the working distance and is directed by optical components along a light path toward a bar code symbol located in the vicinity of the working distance for reflection from the symbol. A photodetector having a field of view extending across and slightly past the symbol detects light of variable intensity reflected off the symbol and generates electrical signals indicative of the detected light. These electrical signals are decoded into data descriptive of the symbol. A scanning component is situated in the light path. The scanning component may either sweep the beam spot across the symbol and trace a scan line across and past the symbol, or scan the field of view of the photodetector, or do both.

In any case, the scanner typically includes a moving mirror. For example, US-A-4,251,798 discloses a rotating polygon having a planar mirror at each side, each mirror tracing a scan line across the symbol. US-A-4,387,297 and US-A-4,409,470 both employ a planar mirror which is repetitively and reciprocally driven in alternate circumferential directions about a drive shaft on which the mirror is mounted. Another arrangement has a multi-mirror construction composed of a generally concave mirror portion and a generally planar mirror portion, the multi-mirror construction being repetitively and reciprocally driven in alternate circumferential directions about a drive shaft on which the multi-mirror construction was mounted.

No matter what the shape or orientation of the mirror, these scanning components employed in laser scanning systems move mirrors to perform the aforementioned sweeping and scanning actions. Moving other laser scanning system components was not thought to be practical. Thus, moving a gas laser tube was unthinkable, particularly in hand-held compact system applications, due to the large size and the requisite large room necessary to accommodate a moving gas laser tube. Moving an optical lens was also not thought to be desirable, becaus optical alignment is critical in laser scanning systems. Hence, it was the mirror that was typically designated to effect th sweeping/scanning functions. However, in some laser scanning applications, mirror movements have not been found to be altogether desirable.

In non-laser scanning systems of the type exemplified by US-A-4,578,571, a non-laser light emitting diode, an optical assembly, a photodetector, and electronic preamplifier-filter circuitry are all fixedly mounted on a common support that is connected to a cantilevered bimorph which is reciprocatingly driven to jointly move all the aforementioned components back and forth over a bar code symbol to be scanned. The large volume and heavy mass of all the commonly-mounted non-laser system components requires the expenditure of a great deal of power for the drive. This is not altogether practical in those cases, e.g. battery-powered operation, where power consumption is to be held to a minimum. Also, moving only one or more non-mirrored system components relative to another for conserving power was heretofore not considered desirable, because of the optical alignment problems described above.

EP-A-0 264 956 relates to a mirror less laser scanning apparatus comprising a scanning head and a floor type unit comprising the light source and being connected to a terminal of the head via a communication cable and an optical fibre 4. US-A-4,409,470 is directed to a laser scanning head containing a field-replaceable laser tube arrangement.

It is a general object of this invention to advance the state of the art of scanner systems for reading indicia of different light reflectivity, particularly but not exclusively laser scanner systems for reading bar code symbols.

Another object of this invention is to eliminate the use and the movement of a mirror to effect sweeping and scanning actions of the outgoing light beam, as it leaves the source.

A further object of this invention is to provide a so-called "mirrorless" scanner system (i.e. one in which system components other than mirrors are used to effect scanning of the beam as it leaves the source) which is compact in size, light in weight, reliable in use, and relatively inexpensive to assemble and manufacture.

Yet another object of this invention is to employ the mirrorless scanner system in a plurality of hand-held, desk-top workstations or built-in system configurations.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims of which claim 1 in its preamble reflects the prior art known from US-A-4 560 862. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, best will be understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Fig. 1A is a partly broken-away, partly sectioned side vi w of a hand-held light scanning system in

which a mirrorless scanner arrangement in accordance with an embodiment of this invention is housed;

Fig. 1B is an end view of Fig. 1A;

Fig. 2 is a front perspective view of the mirrorless scanner arrangement of Fig. 1A;

Fig. 3 is a partly sectioned side view of a mirrorless scanner arrangement which is not in accordance with this invention;

Fig. 4 is a diagrammatic top plan view of the arrangement of Fig. 3, depicting its operation;

Fig. 5 is a partly sectioned side view of a mirrorless scanner arrangement in accordance with another embodiment of this invention;

Fig. 6 is an enlarged view taken on line 6-6 of Fig. 5;

Fig. 7 is a diagrammatic top plan view of the embodiment of Fig. 5 depicting its operation at two end-limiting positions.

Fig. 8 is a rear perspective view of the mirrorless scanner arrangement of Fig. 2 as employed in a multi-axis scanning system;

Fig. 9 is a partly broken-away perspective view of an additional embodiment of the mirrorless scanner arrangement in accordance with this invention;

Fig. 10 is a side view of a gooseneck-type scanning system workstation for use with any of the mirrorless scanner arrangements of this invention;

Fig. 11 is a partly broken-away, perspective view of a hand-held scanning system for use with the mirrorless scanning arrangement; and

Fig. 12 is a perspective view of a hand-held, swivel-type scanning system for use with the mirrorless scanning arrangement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, reference numeral 10 in FIGs. 1A and 1B generally identifies an arrangement in a scanner system for reading symbols, particularly UPC bar code symbols. As used in this specification and the following claims, the term "symbol" is intended to be broadly construed and to cover not only symbol patterns composed of alternating bars and spaces, but also other patterns, as well as alpha-numeric characters and, in short, any indicia having portions of different light reflectivity.

The arrangement 10 comprises a hand-held housing 12 having a base 14 which subdivides the interior of the housing into an upper half 16 and a lower half 18. A lightweight, high-speed, miniature scanning motor 20 similar to that described in US-A-4,496,831 is mounted on base 14. The motor 20 has an output shaft 22 which is repetitively driven in alternate circumferential directions about an axis along which the shaft extends over arc lengths less than 360° in each direction. Structural, functional and operational aspects of the motor 20 and of control circuitry 24 for the motor are set forth in detail in US-A-4,496,831 and, hence, for the sake of brevity, will not be repeat d herein.

One difference between the motor 20 herein described and the motor of US-A-4,496,831 is the superstructure that is mounted on the output shaft 22. Instead of a planar mirror as taught by said patent, according to FIG. 1A a generally U-shaped support 26 at the end of the shaft 22 and a laser/optics subassembly 28 is mounted on the support 26. The subassembly 28 and the support 26 are jointly oscillated and turned with the shaft 22.

The subassembly 28 includes an elongated hollow tube 30, a laser diode 32 fixedly mounted at one axial end region of the tube 30, a lens barrel 34 mounted at the opposite axial end region of the tube 30, and a focusing lens 36 mounted within the barrel (see FIG.3). The focusing lens 36 is preferably a plano-convex lens, but may be spherical, convex or cylindrical as well. The barrel 34 has an end wall formed with an aperture stop 38 which is an opening extending through the end wall. The barrel 34 is mounted for longitudinal telescoping movement within and along the tube 30. The lens 36 is situated adjacent the end wall of the barrel and is mounted for joint movement with the barrel. The position of the barrel and, in turn, of the lens relative to the diode is fixed typically by gluing or clamping, at the assembly site so that a known distance between the lens and the aperture stop, on the one hand, and between the lens, the aperture stop and the diode, on the other hand, is obtained. A coil spring 37 (see FIG. 3) is located within and extends along the barrel and tube, and has one coil end bearing against the diode, and another coil end bearing against a planar side of the lens. The spring urges the lens against the end wall having the aperture stop, thereby fixedly locating the lens relative to the aperture stop.

The subassembly 28, per se, forms no part of this invention. It is sufficient to understand that the subassembly 28 includes a solid-state laser diode 32 operative for propagating and generating an incident laser beam, either in the invisible or visible light range, and the combination of a focusing lens and an aperture stop together operative for focusing the laser beam to have a beam cross-section or beam spot of a certain waist size within a range of working distances relative to the housing 12. The focused beam passes through the aperture stop 38 and through a scan window 40 on the housing in the vicinity of a reference plane located exteriorly of the housing within the range of working distances along an outgoing optical path.

During the alternate, repetitive oscillations of the shaft 22, the support 26 and the subassembly 28 likewise participate in this oscillatory movement, thereby causing the beam spot to be swept in an arc whose center of curvature is located at the diode across the symbol at the reference plane and to trace a curved scan line thereat. Hence, no longer is a mirror used to effect sweeping of a beam spot across a symbol, but, inst ad,

other scanner components are moved and, in th m-bodiment of FIG. 1A, these other components comprise the laser diode 32 and the optical components which are jointly turned as a unitary structure about an axis parallel to the reference plane.

A portion of the light reflected off the symbol passes along a return path through a second window 42 on the housing in the direction of arrow B to a photodetector 44 for detecting the variable intensity of the returning portion of the reflected laser light over a field of view; and for generating an electrical analog signal indicative of the detected variable light intensity. In the FIG. 1A embodiment, the photodetector 44 is stationarily mounted on the printed circuit board 46. Printed circuit boards 48 and 50 at either side of board 46 contain signal processing circuitry 52 and microprocessor control circuitry 53 for converting the analog electrical signal to a digital signal, and for processing the digital signal to data descriptive of the symbol being read. Details of the signal processing and microprocessor control circuitry can be had by reference to the above-identified patents.

A two-part multi-wire plug-in cable connector 54 has one part electrically connected to the signal processing and microprocessor control circuitry and another part electrically connected to a flexible multi-wire cable 54' connected to a display 55 and a keyboard 56. A rechargeable battery pack 58 supplies power to the laser diode and the electrical circuitry in the housing. By moving only the laser diode and the optical component relative to the stationary photodetector, power from the battery pack is conserved.

Means for initiating reading may advantageously include a trigger 60 mounted on the housing 12. The trigger extends in part outwardly of the housing to be manually actuated by a user who is holding the housing 12 in his hand. The trigger is operatively connected through trigger switch 62 and actuates the laser diode 32, the motor 20, the photodetector 44, the signal processing circuitry 52 and the control circuitry 53 to initiate a reading of the symbol. The trigger is actuated once for each symbol to be read, each symbol in its respective turn. Once the control circuitry determines that the symbol has been successfully decoded, the control circuitry terminates the reading of the symbol and deactuates the previously actuated components in the housing and readies the system for the next symbol.

FIG. 2 illustrates the various electrical, mechanical and optical components assembled as a modular unit prior to mounting in the upper half 16 of the housing 12 of FIGs. 1A, 1B. The electrical circuitry on the printed circuit boards 46, 48, 50, as well as on base 14, has been omitted from FIG. 2 for the sake of clarity.

Turning now to FIG. 3 (which as Fig. 4 does not form part of the present invention), like parts with that of FIG. 1A have been identified with like reference numerals. The oscillating motor 20, once again, has an output shaft 22 on which a generally U-shap d support 26 is mounted. A laser/optics subassembly 28 is mounted on one leg 64 of th support. A photodetector 44 is mounted on another leg 66 of the support. Coiled tensile wire groups 68, 70 connect the diode 32 and the photodetector 44 to the non-illustrated electrical circuitry on printed circuit board 48. Although coiled wires have been illustrated, other types of electrical connectors, e.g. flat cable, could be employed. A collecting lens 72 is mounted on leg 64 and coaxially surrounds subassembly 28. The lens 72, the subassembly 28 and the photodetector 44 all have a common boresight or optical axis 74 along which the optical and return paths are co-linear, and are all oscillatable as a unit in alternate circumferential directions (see double-headed arrow 76 in FIG. 4) about the axis along which shaft 22 extends.

The operation of the FIG. 3 arrangement is schematically shown in FIG. 4. An incident laser beam is emitted from the subassembly 28. In a center position, this beam is directed along optical axis 74 to a reference plane 78 at which a symbol is located. Light is scattered in all directions from the symbol. A portion of the reflected light, as represented by light rays 79,81, is incident on collecting lens 72, e.g. a Fresnel lens, and focused onto an inlet of the photodetector 44. The inlet may be round, square or rectangular (see FIG. 6). As the unit turns in the direction of either arrow 76, the beam spot at the reference plane likewise moves across the symbol. The returning light is always focused onto the inlet of the photodetector.

The FIG. 3 arrangement is retro-reflective because not only the incident beam, but also the field of view of the photodetector, are being simultaneously scanned across the symbol. By contrast, the FIGs. 1A, 1B embodiment is a so-called "flying spot" scanner, because only the incident beam is being swept across the symbol, the photodetector being stationary.

Turning now to the embodiment of FIGs. 5-7, like reference numerals again identify like parts. The oscillating motor 20, once again, has an output shaft 22 on which a support 80 is mounted. Rather than being U-shaped like support 26, support 80 is L-shaped and has an upright leg 82. A laser/optics subassembly 28 is mounted on leg 82. A photodetector 44 is stationarily mounted on printed circuit board 46. Coiled tensile wire group 68 interconnects the diode 32 and electrical circuitry on board 46. Collecting lens 72 is mounted on leg 82 in a coaxially surrounding relationship with subassembly 28. The lens 72 and the subassembly 28 turn as a unit in either direction of double-headed arrow 76, whereas photodetector 44, is stationary.

As schematically shown in FIG. 7, an incident light beam emitted from subassembly 28 is directed in one end-limiting position along optical axis 84 to impinge on a symbol located at the reference plane 78, whereupon a portion of th r fl cted light, as repr sented by light rays 86, 88, is incident on collecting lens 72 and focused at on end 90 of an elongated slot-like inlet 92 of the photodetector 44, best shown in FIG. 6. At an opposite end-limiting position, shown in phantom lines in FIG. 7,

the collected portion of reflected light is focused at an opposite end 94 of the inlet 92. Between end-limiting portions, the collected, focused light travels lengthwise along the inlet 92.

The FIGs. 5-7 embodiment is a retro-reflective arrangement, because both the incident beam is being swept across the symbol, and the field of view of the photodetector is likewise being swept across the symbol at the same time due to the movement of the collecting lens. The collecting lens could be eliminated by having the output power of the light source sufficiently high.

As described so far, the various embodiments describe a single curved trace or scan line in one direction across the symbol being read. FIG. 8 shows an arrangement for generating a scan pattern extending in more than one direction over the symbol. Thus, as before, motor 20 repetitively drives output shaft 22, support 26 and laser/optics subassembly 28 in the alternate directions indicated by arrows 76. Tensile wire group 68 interconnects the diode 32 with a low voltage power supply 96. The motor and its superstructure are mounted on a horizontal platform 98 of a base 100.

The base has additional platforms for other components. Thus, horizontal platform 102 supports a collecting lens 104. Platform 106 supports a photodetector 44 on an upper surface, as well as a printed circuit board 108 on which signal processing circuitry is mounted on a lower surface.

A second motor 20' identical to motor 20 is mounted on a vertical platform 110 and has an output shaft 22' which is at right angles to shaft 22. Instead of the aforementioned superstructure, a planar mirror 112 is mounted at one end of shaft 22', thereby being similar to the scanning element described in US-A-4,496,831. The motor 20' drives the mirror 112 in alternate circumferential directions as indicated by double-headed arrow 114.

In operation, with motors 20, 20' both oscillating the components mounted on their shafts, a scan pattern composed of multiple lines is generated over the symbol. Thus, with motor 20 generating a single scan line along an X-axis direction, motor 20' will move the single scan line along a Y-axis, thereby generating a set of mutually parallel lines extending across the pattern. By varying the speed, direction and frequency of the motors 20, 20', complex scan patterns, e.g. Lissajous patterns, can be generated.

Due to the oscillatory movement of the laser/optics subassembly 28, the tensile wires 68 interconnecting the diode and its power supply 96 are subjected to considerable stress. The mechanical integrity of the wire joints is weakened by such stress forces generated while the subassembly changes directions. Gen rally speaking, these stress forces are proportional to the distance between the shaft 22 and the point of the wire attachment to the subassembly.

FIG. 9 shows an arrangement wherein the wire joints between the diode and its power supply are positioned in the immediate vicinity of the shaft, thereby minimizing the stress forces acting to weaken such joints and maximizing the working lifetime of the arrangement.

Thus, a support block 26" is mounted on the shaft 22, but off to one side of the shaft. The subassembly 28 is mounted on the block 26". A printed circuit board 116 is mounted at the side of the block facing the shaft 22. The board 116 has three printed conductive strips 118a, 118b, 118c extending along the board 116. The laser diode 32 has a first group of wires 68 connected to respective ends of the strips; and a second group of wires 120 is connected to respective opposite ends of the strips and to the power supply 96. The subassembly 28, the board 116 and the first group of wires 68 are jointly oscillated. The second group of wires 120 is subjected to stress forces, but, as shown, the wire joints at the opposite ends of the strips are immediately adjacent the shaft 22 so that the magnitude of the stress forces is much reduced as compared to the situation wherein the first group of wires 68 were directly connected to the power supply 96.

FIG. 10 shows a desk-top workstation wherein a housing 121 generally having the same shape as the upper half of housing 12 in FIG. 1A is mounted above a base 123 situated on a generally horizontal support surface such as a tabletop 125. A gooseneck-type semi-rigid, bendable, conduit 127 interconnects the housing 121 with the base 123 and enables the housing to be manually bendably positioned in any desired orientation relative to the base and to be maintained in the desired orientation. The light beam emitted from the housing can thus be positioned at any desired angle relative to the symbol to be read.

Advantageously, the base 123 is hollow and contains signal processing circuitry which is connected by electrical wires running through the conduit 127 to the mirror scanning arrangement contained in the housing 121. Instead of the base, the end of the conduit remote from the housing 121 could be attached to a cash register, analogous point-of-sale apparatus, or a fixed mount, e.g. on a production line.

Fig. 11 shows the compact laser/optics sub-assembly 28 mounted on the reciprocating motor 20, as described above, installed in a hand-held housing 210 equipped with a display 212 and a keyboard 214. The housing 210 has a rectangular cross-section and, at its top, is provided with a superstructure that enables scanning to be performed to the right or, in another mode of operation, to the left of the housing.

The housing 210 has a top rectangular wall 216 fixedly mounted in place with the aid of four screws 218 at the corners of the top wall. A hood 220 is mounted at one end of the top wall. A stationary reflecting mirror 222 is located within the confines of the hood above the top wall 216. A scan window 224 closes the interior of the hood from the environm nt. The mirror 222 is positioned in the path of the emitted laser beam emanating from the laser/optics subassembly 28, and redirects the laser beam toward one sid , .g. toward the right side, of th

housing. Returning light from the symbol being read passes through the window 224 and is collected by photodetector 44.

By removing the four screws 218, turning the by 180°, replacing the screws 218, the scanning arrangement will work just as described above, except that, this time, the mirror 222 will redirect the laser beam toward the other side, e.g. toward the left side, of the housing. In this way, right-and left-handed users can be accommodated.

To the same effect is the structure shown in Fig. 12, in which the emitted beam can also be directed toward the right or the left. A housing 226 of cylindrical cross-section has a circular top wall 228 on which a hood 230 is supported. A reflecting mirror identical to mirror 222 is mounted within hood 230. A scan window 232 closes the hood 230. An L-shaped locking lug 234 depends from the top wall 228 and, in the illustrated position, lockingly engages a hook 236 provided on the circular side wall of the housing 226. The same laser/optics sub-assembly shown in Fig. 11 is mounted within housing 226. The laser beam is propagated toward the right in Fig. 12.

To accommodate the user, the top wall 228 and hood 230 can be turned to the position shown in phantom lines until the lug 234 engages another non-illustrated hook spaced 180° away from hood 236. In this locked position, the laser beam is propagated toward the left in Fig. 12. The swivelling of a locking lug to engage one or the other of two hooks with a snap-type action is somewhat easier to perform than the removal and replacement of screws as described for Fig. 11.

In all of the various embodiments, the mirrorless scanning arrangement is very compact in size. This allows the arrangement to be fabricated as a module that can be installed in many different types of laser scanning systems. The module advantageously comprises a laser/optics subassembly mounted on a support such as a reciprocating scan component, together with a photodetector, all of which are connected to an electrical connector to enable the module to be electrically connected to other electrical components.

It will be understood that each of the elements described above, or two or more together, also may find a useful application in other types of constructions differing from the types described above.

Claims

1. A replaceable modular light-scanning assembly for use in a light scanning system adapted for reading indicia having parts of differing reflectivity, the assembly comprising:

   (a) a light source component (32) for emitting a light b am;
   (b) an optical component (34,36) for optically modifying and directing the light beam along an optical path (74) towards indicia located in the vicinity of a reference plane exteriorly of the system;
   (c) a photodetector component (44) having a field of view and operative for detecting at least a portion of light of variable intensity reflected off an indicia, and for generating an electrical signal indicative of the detected light intensity;
   (d) a common support (14) on which the light source component, the optical component and the photodetector component are mounted;
   (e) connector means (54') for electrically and detachably interconnecting the assembly, in use, to other components; characterised in that the light source component (32) and the optical component (34,36) together form a sub-assembly (28) which is mounted on a sub-assembly support (26,80), in that the optical component comprises a lens, and in that scanning motion of the light beam is effected only by drive means (20) which reciprocatingly moves the sub-assembly support (26,80) with respect to the photodetector component (44) and the common support (14).

2. A replaceable assembly as claimed in claim 2 in which the sub-assembly (28) comprises a laser/optics sub-assembly including a semiconductor laser diode (32), a focusing lens (36) and an aperture stop (38).

3. A replaceable assembly as claimed in claim 1 in which the photodetector component (44) is mounted to a printed circuit board (46) of the common support (14).

4. A replaceable assembly as claimed in claim 1 or claim 2 in which the drive means (20) turns the sub-assembly (22) in alternate circumferential directions about an axis.

5. A replaceable assembly as claimed in claim 5 in which the drive means (20) moves the sub-assembly (28) in a plane which is substantially perpendicular to an optical axis which extends along the optical path.

6. A replaceable assembly as claimed in any one of the preceding claims in which the scanning motion is effected in one direction and in which scanning motion in a perpendicular direction is further effected by reflecting the light beam from an oscillating mirror (112).

7. An apparatus including a replaceable light-scanning assembly as claimed in any one of the preceding claims.

8. An apparatus as claimed in claim 7 including a housing having a hand-held head portion including manually actuated trigger means operative for initiating reading of an indicia.

9. An apparatus as claimed in claim 7 comprising a desk-top workstation.

10. An apparatus as claimed in claim 7 comprising a stationary installation.

Patentansprüche

1. Ersetzbare modulare Lichtabtastanordnung zur Verwendung in einem Lichtabtastsystem, geeignet zum Lesen von Anzeigemitteln (indicia) mit Teilen unterschiedlicher Reflektivität, wobei die Anordnung folgendes aufweist:

   (a) eine Lichtquellenkomponente (32) zum Emittieren eines Lichtstrahls;
   (b) eine optische Komponente (34, 36) zur optischen Modifizierung und Leitung des Lichtstrahls entlang eines optischen Pfades (74) zu den Indizien hin, die in der Nähe einer Bezugsebene außerhalb des Systems angeordnet sind;
   (c) eine Photodetektorkomponente (44) mit einem Gesichtsfeld und betriebsfähig zum Detektieren von mindestens einem Teil des Lichtes variabler Intensität, welches von einem Anzeigemittel reflektiert wird, und zur Erzeugung eines für die detektierte Lichtintensität eine Anzeige bildenden elektrischen Signals;
   (d) ein gemeinsamer Träger (14) auf dem die Lichtquellenkomponente, die optische Komponente und die Photodetektorkomponente angebracht sind;
   (e) Verbindermittel (54') zur elektrischen und trennbaren Verbindung der Anordnung, im Gebrauch, mit anderen Komponenten; dadurch gekennzeichnet, daß die Lichtquellenkomponente (32) und die optische Komponente (34, 36) zusammen eine Unter-Anordnung (28) bilden, die auf einem Unter-Anordnungsträger (26, 80) angeordnet ist, daß die optische Komponente eine Linse aufweist und daß die Abtastbewegung des Lichtstrahls nur durch Antriebsmittel (20) bewirkt wird, die dem Unter-Anordnungsträger (26, 80) bezüglich der Photodetektorkomponente (44) und des gemeinsamen Trägers (14) hin- und herbewegen.

2. Ersetzbare Anordnung nach Anspruch 1, wobei die Subanordnung (28) eine Laser/Optik-Unteranordnung aufweist einschließlich einer Halbleiterlaserdiode (32), einer Fokussierlinse (36) und einer Aperturblende (38).

3. Ersetzbare Anordnung nach Anspruch 1, wobei die Photodetektorkomponente (44) auf einer gedruckten Schaltungsplatte (46) des gemeinsamen Trägers (14) angebracht ist.

4. Ersetzbare Anordnung nach Anspruch 1 oder 2, wobei die Antriebsmittel (20) die Subanordnung (22) in alternierenden Umfangsrichtungen um eine Achse drehen.

5. Ersetzbare Anordnung nach Anspruch 5, wobei die Antriebsmittel (20) die Subanordnung (28) in einer Ebene bewegen, die im wesentlichen senkrecht zu einer optischen Achse verläuft, die sich entlang des optischen Pfades erstreckt.

6. Ersetzbare Anordnung nach einem der vorhergehenden Ansprüche, wobei die Abtastbewegung in einer Richtung bewirkt wird und wobei die Abtastbewegung in einer senkrechten Richtung ferner bewirkt wird durch Reflektieren des Lichtstrahls von einem Oszillationsspiegel (112).

7. Vorrichtung mit einer ersetzbaren Lichtabtastanordnung nach einem der vorhergehenden Ansprüche.

8. Vorrichtung nach Anspruch 7 mit einem Gehäuse mit einem in der Hand zu haltenden Teil einschließlich manuell betätigter Auslösermittel zur Initiierung des Lesens eines Anzeigemittels.

9. Vorrichtung nach Anspruch 7, wobei diese eine auf dem Tisch anzuordnende Arbeitsstation (workstation) aufweist.

10. Vorrichtung nach Anspruch 7, wobei diese eine stationäre Installation aufweist.

Revendications

1. Ensemble de balayage optique modulaire remplaçable destiné à être utilisé dans un système de balayage optique conçu pour lire des signes ayant des parties de réflectivités différentes, l'ensemble comprenant :

   (a) un composant (32) à source lumineuse pour émettre un faisceau lumineux ;
   (b) un composant (34, 36) optique pour modifier optiquement et diriger le faisceau lumineux suivant un chemin (74) optique vers des signes situés au voisinage d'un plan de référence à l'extérieur du système ;
   (c) un composant (44) photodétecteur ayant un

champ de vue et ayant pour fonction de détecter au moins une partie de la lumière à intensité variable réfléchie par un signe, et de générer un signal électrique représentatif de l'intensité lumineuse détectée ;
(d) un support (14) commun sur lequel sont montés le composant à source lumineuse, le composant optique et le composant photodétecteur ;
(e) des moyens (54') connecteurs pour interconnecter électriquement et de façon amovible l'ensemble, lorsqu'il est utilisé, à d'autres composants ;

caractérisé en ce que le composant (32) à source lumineuse et le composant (34,36) optique forment ensemble un sous-ensemble (28) qui est monté sur un support (26,80) de sous-ensemble, en ce que le composant optique comprend une lentille, et en ce que le mouvement de balayage du faisceau lumineux est effectué seulement par des moyens (20) d'entraînement qui déplacent de façon alternée le support (26,80) de sous-ensemble par rapport au composant (44) photodétecteur et au support (14) commun.

2. Ensemble remplaçable selon la revendication 2, dans lequel le sous-ensemble (28) comprend un sous-ensemble à laser/optique comportant une diode (32) laser à semiconducteur, une lentille (36) de focalisation et une pupille (38).

3. Ensemble remplaçable selon la revendication 1, dans lequel le composant (44) photodétecteur est monté sur une carte (46) de circuit imprimé du support (14) commun.

4. Ensemble remplaçable selon la revendication 1 ou la revendication 2, dans lequel les moyens (20) d'entraînement font tourner le sous-ensemble (22) dans des directions circonférentielles alternées autour d'un axe.

5. Ensemble remplaçable selon la revendication 5, dans lequel les moyens (20) d'entraînement déplacent le sous-ensemble (28) dans un plan qui est sensiblement perpendiculaire à un axe optique qui s'étend suivant le chemin optique.

6. Ensemble remplaçable selon l'une quelconque des revendications précédentes, dans lequel le mouvement de balayage est effectué dans une direction et dans lequel un mouvement de balayage dans une direction perpendiculaire est en outre effectué en réfléchissant le faisceau lumineux sur un miroir (112) oscillant.

7. Appareil comportant un ensemble d balayag optique remplaçable selon l'une quelconque des revendications précédentes.

8. Appareil selon la revendication 7, comportant un boîtier ayant une partie de tête tenue à la main comportant des moyens de déclenchement actionnés manuellement ayant pour fonction de déclencher la lecture d'un signe.

9. Appareil selon la revendication 7, comprenant une station de travail de bureau.

10. Appareil selon la revendication 7, comprenant une installation stationnaire.

FIG. 1A

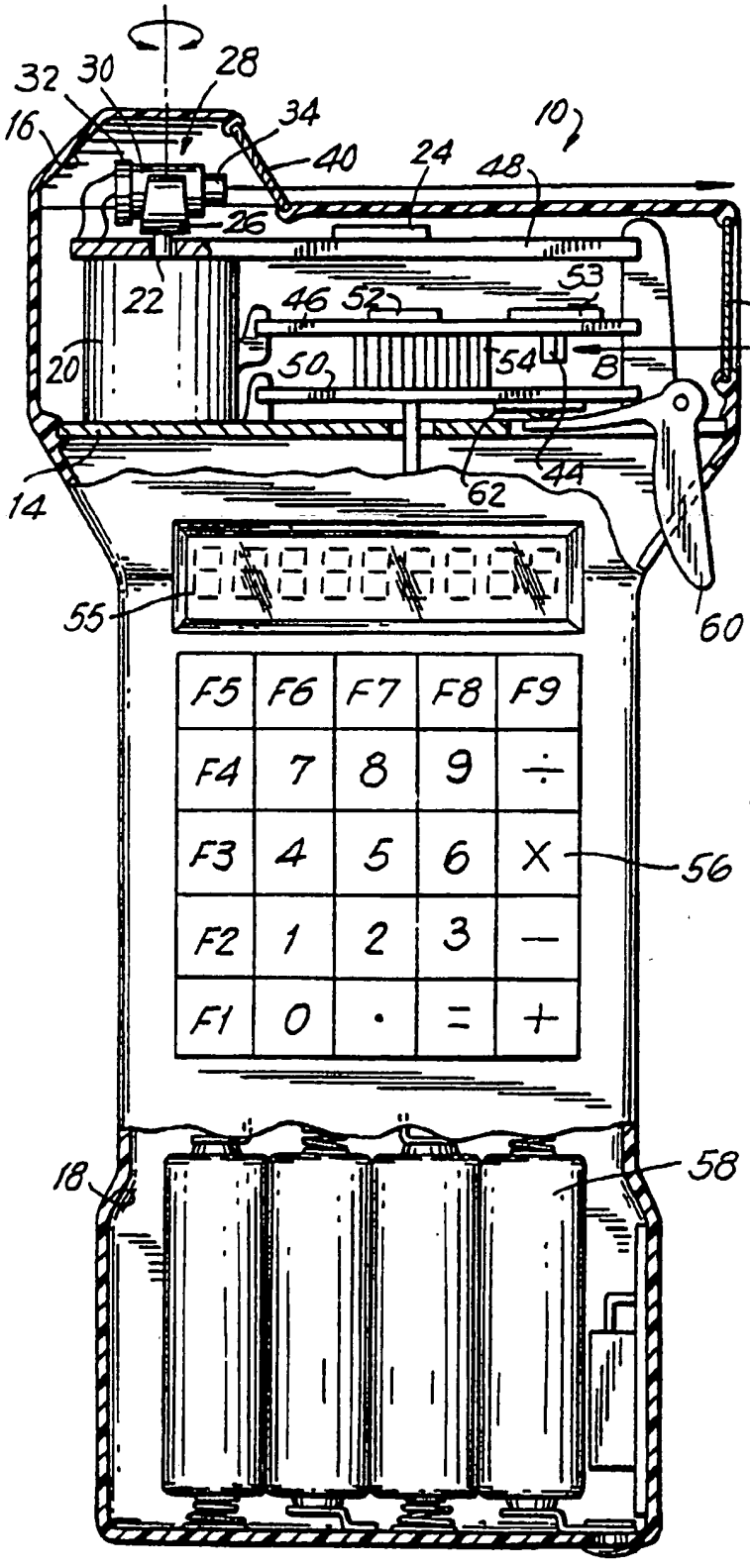
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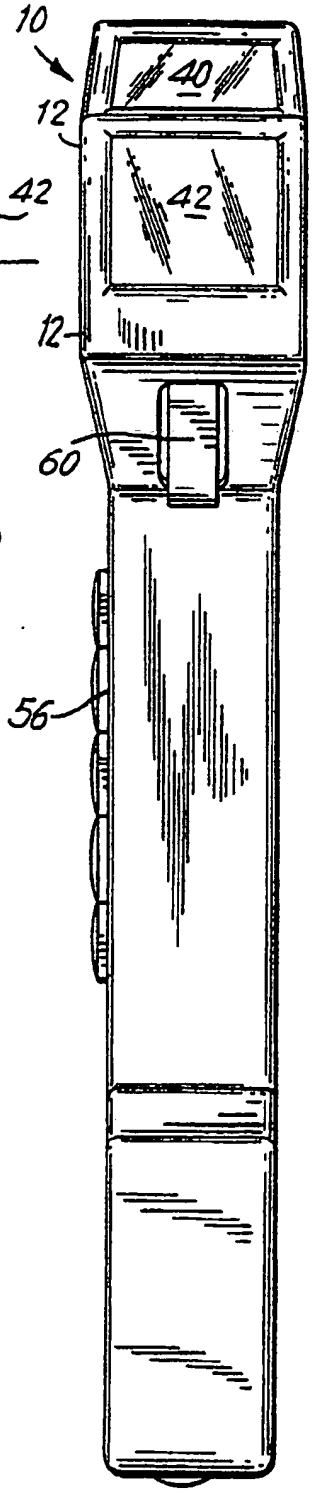
FIG. 1B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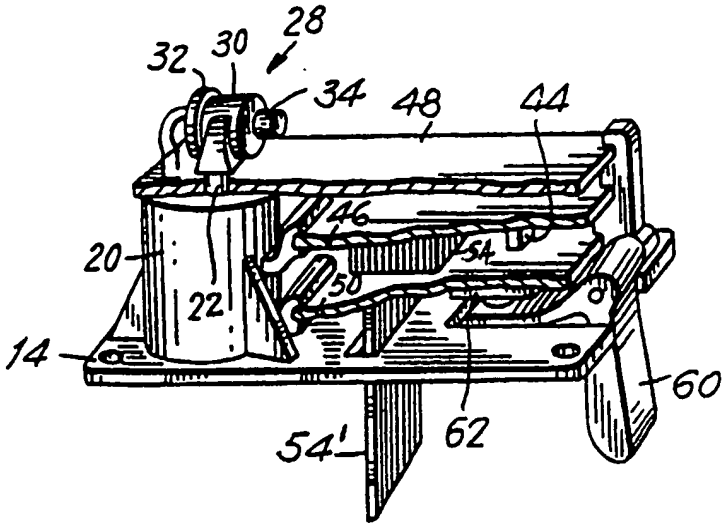
56

FIG. 2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22
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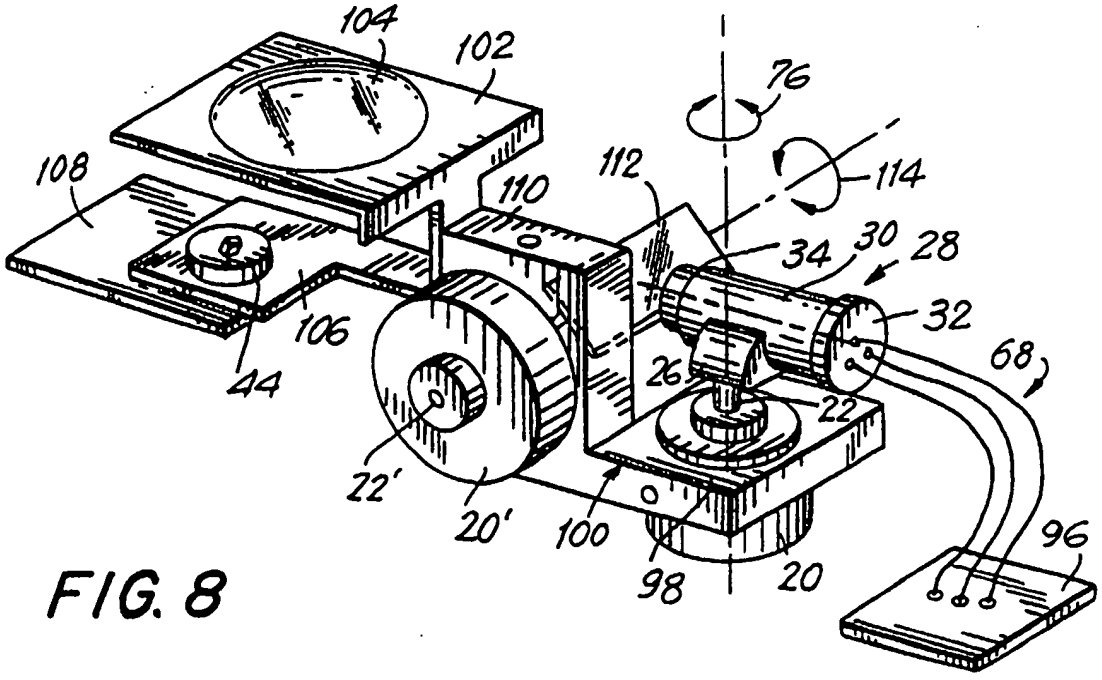
60
62
54'


104
102
76
108
110
112
114
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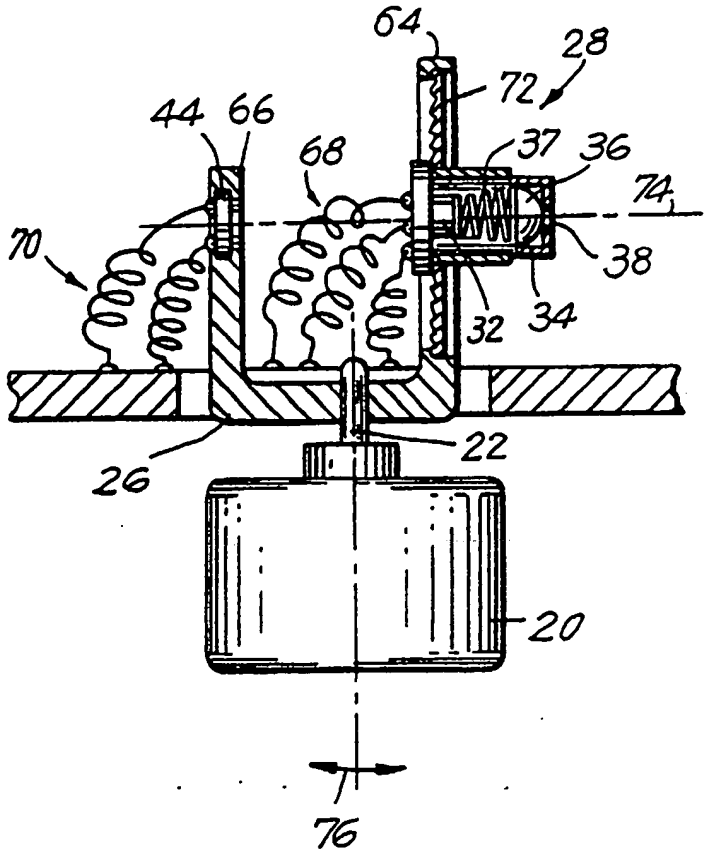
32
106
44
26
68
22
22'
20'
100
98
20
96

FIG. 8

FIG. 3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34
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26
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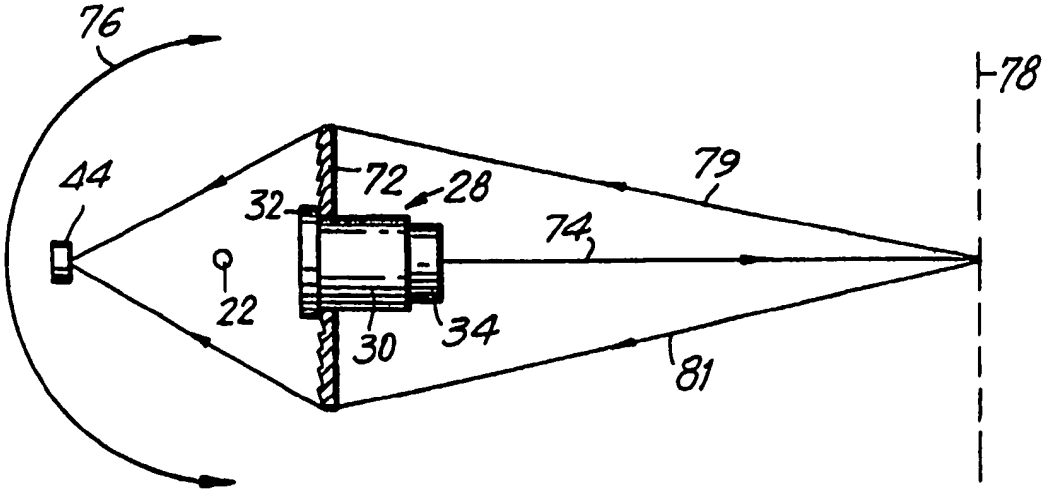
76

FIG. 4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74
22
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34
81

FIG. 5

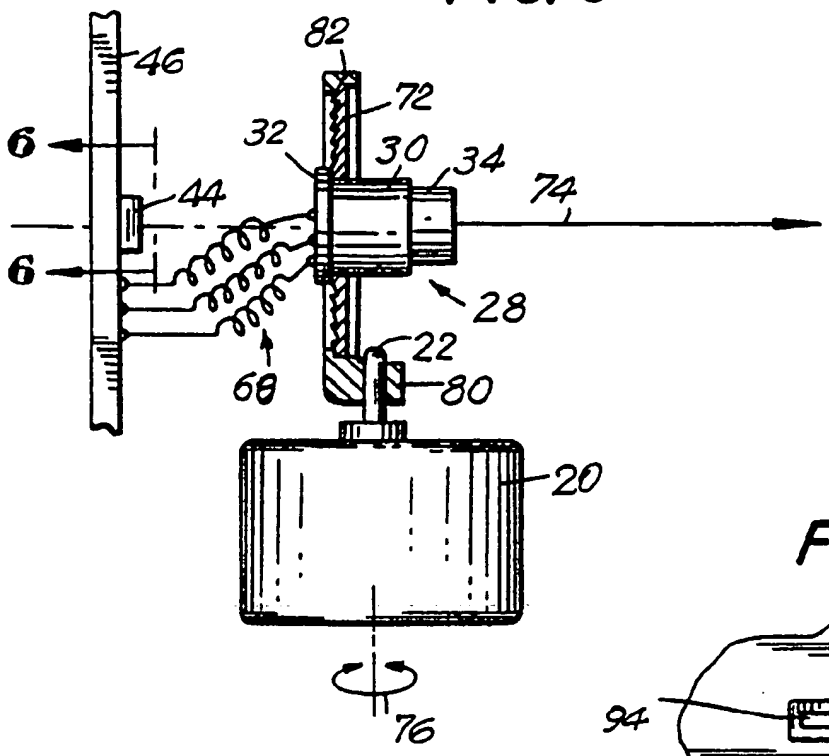


FIG. 6

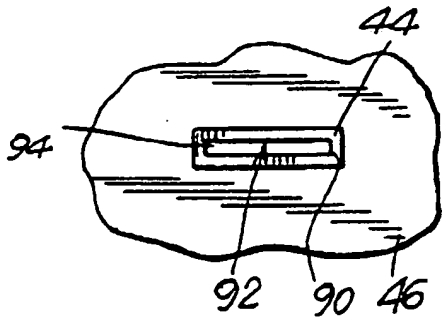
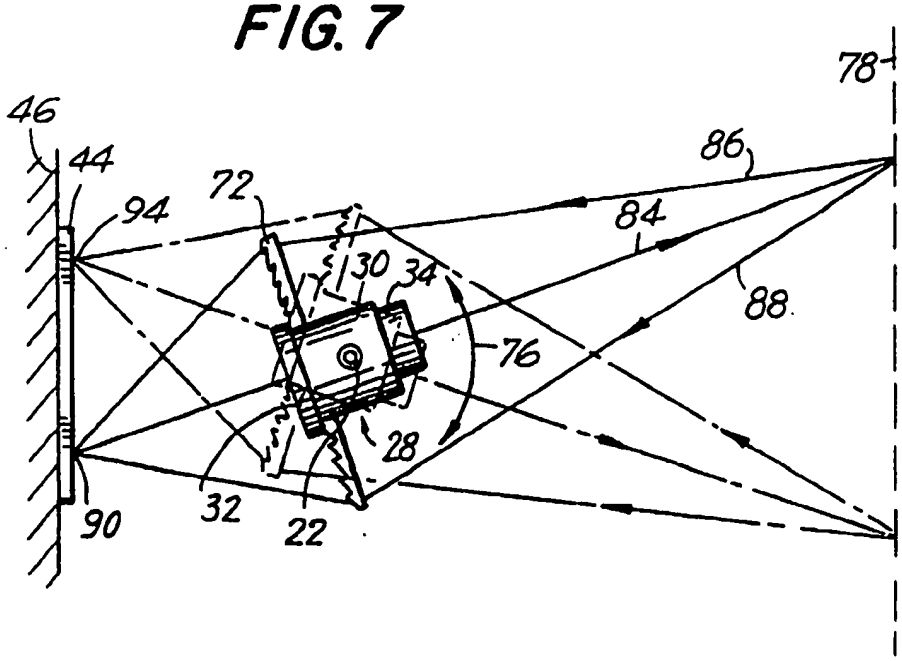
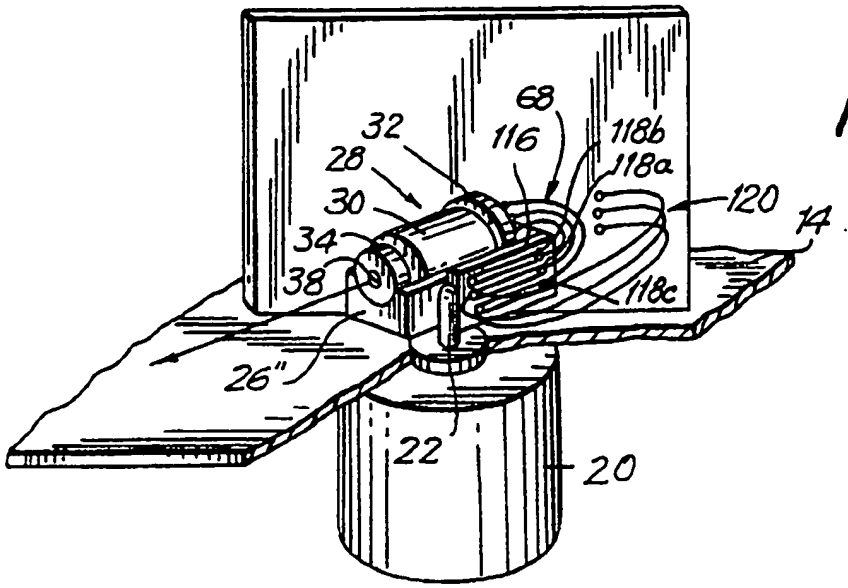


FIG. 7

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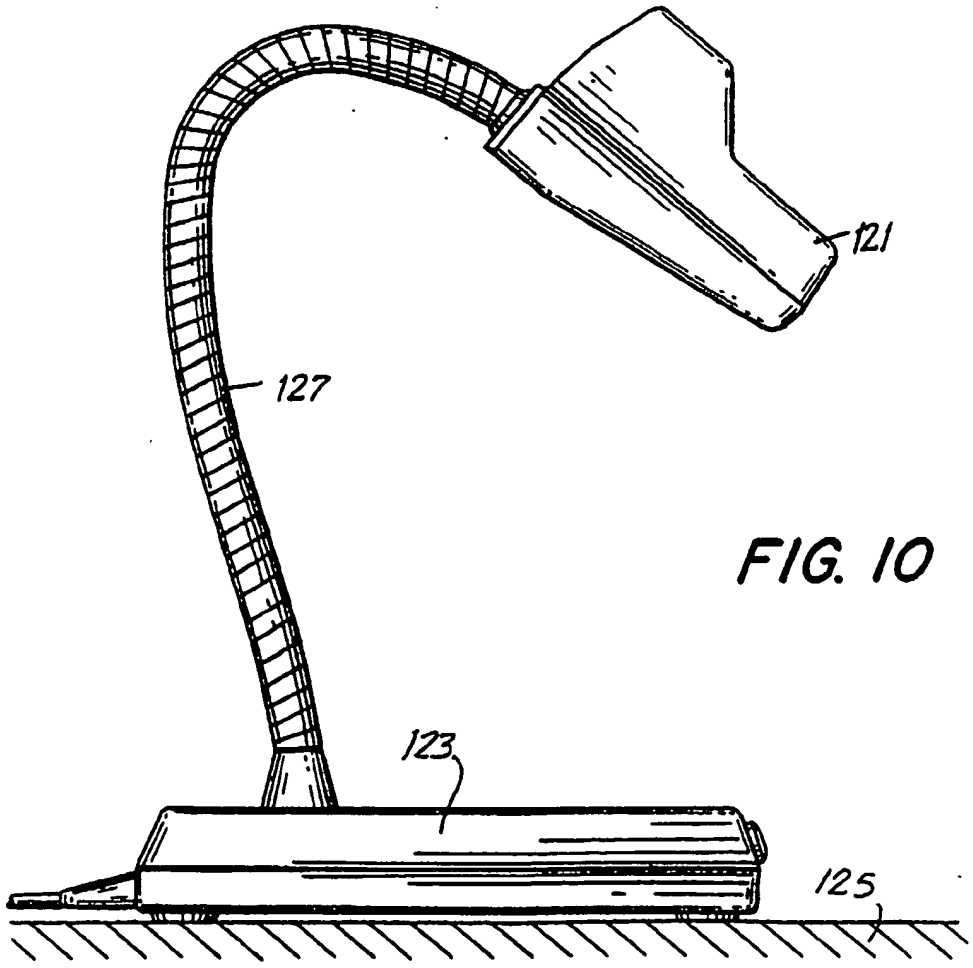
32
116
118b
28
118a
30
120
14
34
38
118c
26"
22
20

FIG. 9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123
125

FIG. 10

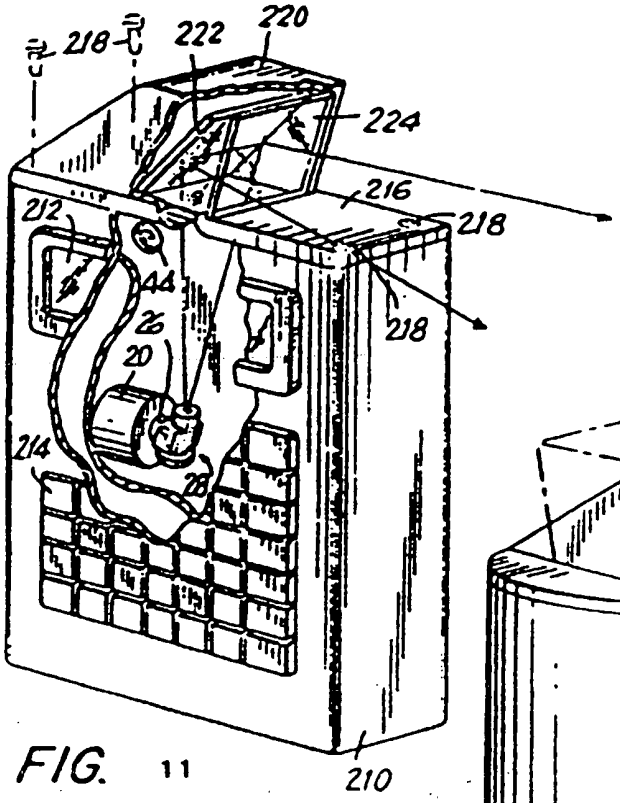
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FIG. 11

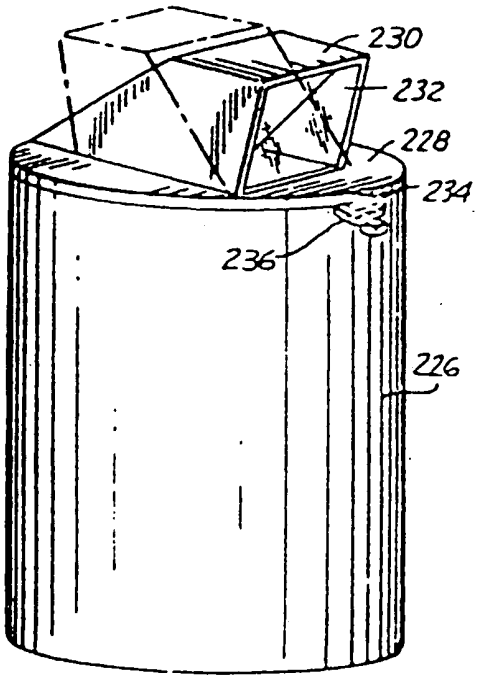
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FIG. 12